ILRI RESEARCH BRIEF 46
June 2015

Aflatoxin contamination of milk and feeds in the greater Addis Ababa milk shed in Ethiopia

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Introduction

Aflatoxins are toxic metabolites of Aspergillus fungi that can contaminate various food and feed products. Aflatoxin B1 (AFB1) is of particular importance, as it is highly carcinogenic, causing liver cancer in humans. When ingested, AFB1 is converted to aflatoxin M1 (AFM1) and is secreted in the milk of lactating mammals. In children, exposure to aflatoxins can cause stunting. In livestock, consumption of aflatoxin contaminated feed reduces productivity, which can result in serious economic losses.

Methodology

A cross-sectional study was conducted in the greater Addis Ababa milk shed between September 2014 and February 2015, led by the International Livestock Research Institute (ILRI). The greater Addis Ababa milk shed is the largest market-oriented milk producing area in Ethiopia and includes peri-urban and urban smallholder and commercial dairy farms. The greater Addis Ababa milk shed is nested in the Central Highlands and serves as the major milk supplier to urban markets in and around Addis Ababa, mostly through informal market channels.

Milk and feed samples were analyzed using commercial enzyme-linked immunosorbent assay kits. Statistical analysis included regression modelling to determine risk factors for aflatoxin contamination in both milk and feed.

Objectives of the project

- To detect and quantify the concentration of AFM1 in raw cow's milk.
- To detect and quantify the concentration of AFB1 in dairy feed.
- To assess the knowledge and practices of dairy value chain actors on aflatoxins and moulds in feed and milk.

Key results

There are very high levels of aflatoxin contamination in milk in the greater Addis Ababa milk shed

- All the milk samples analysed were contaminated with AFM1.
- Most of the samples had aflatoxin levels exceeding the Food and Agriculture Organization of the United Nations (FAO)/World Health Organization (WHO) and European Union (EU) limits.
- The prevalence and concentration of AFM1 in milk in this milk shed was among the highest reported in the world.

There are very high levels of aflatoxin contamination in dairy feeds in the greater Addis Ababa milk shed

- All the feed samples analysed were contaminated with AFB1.
- All of the samples had aflatoxin levels exceeding the FAO/WHO and EU limits.

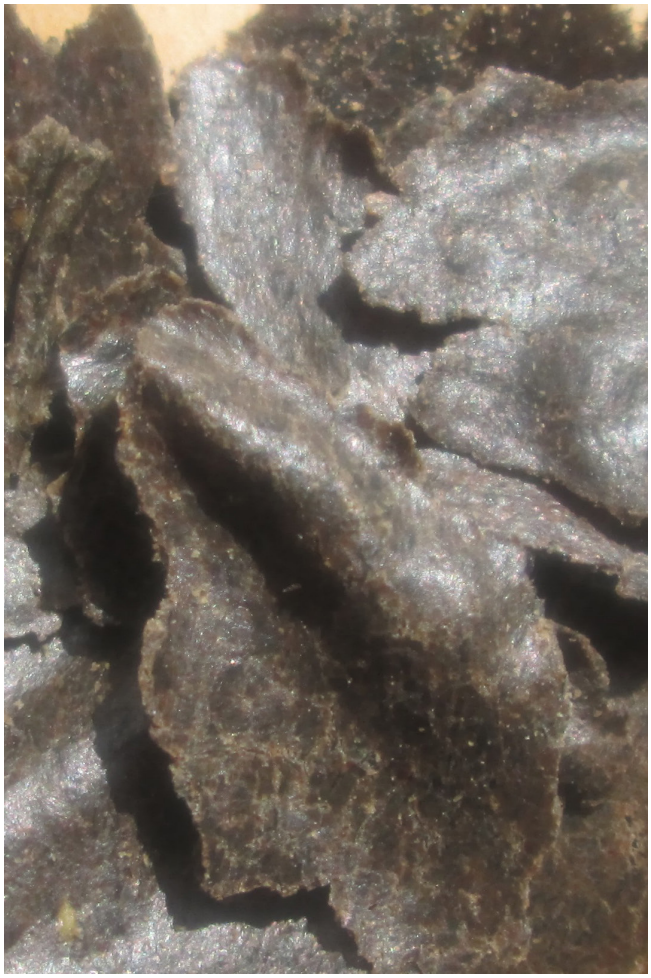
The presence of noug cake in the feed increases aflatoxin contamination in both feed and milk

- All dairy farmers used concentrates every day to feed cattle of all ages. The most common ingredients in concentrate feeds were wheat bran, noug (*Guizotia abyssinica* or Niger seed) cake, pea hulls and maize grain. Dairy farmers also widely used agro-industrial by-products including Brewer's dry yeast from beer factories.
- Wheat bran, maize grain and Brewer's dry yeast had relatively low levels of aflatoxin contamination.
- Noug cakes were highly contaminated with AFB1.
- The presence of noug cake in the feed significantly increased AFB1 in feed and AFM1 in milk.

Feed storage conditions in Ethiopia are conducive to the accumulation of moulds and aflatoxins

Awareness of aflatoxins is very low along the dairy value chain

- Over 90% of dairy farmers did not know that milk could be contaminated with aflatoxins.
- Feed producers and processors were more aware of aflatoxins than other chain actors.
- Most value chain actors knew of the harmful effects of moulds on human and animal health.



Noug cake was highly contaminated with AFB1. Noug cake is a common feed ingredient in the greater Addis Ababa milk shed.

Feed storage conditions are conducive to the accumulation of aflatoxins

- Feed is mostly stored in plastic bags which do not provide adequate ventilation.
- Quality assessment of feed is limited to visual inspection.
- Feed is sometimes stored for up to six months.
- Preventive measures to reduce mould growth and contamination are uncommon.

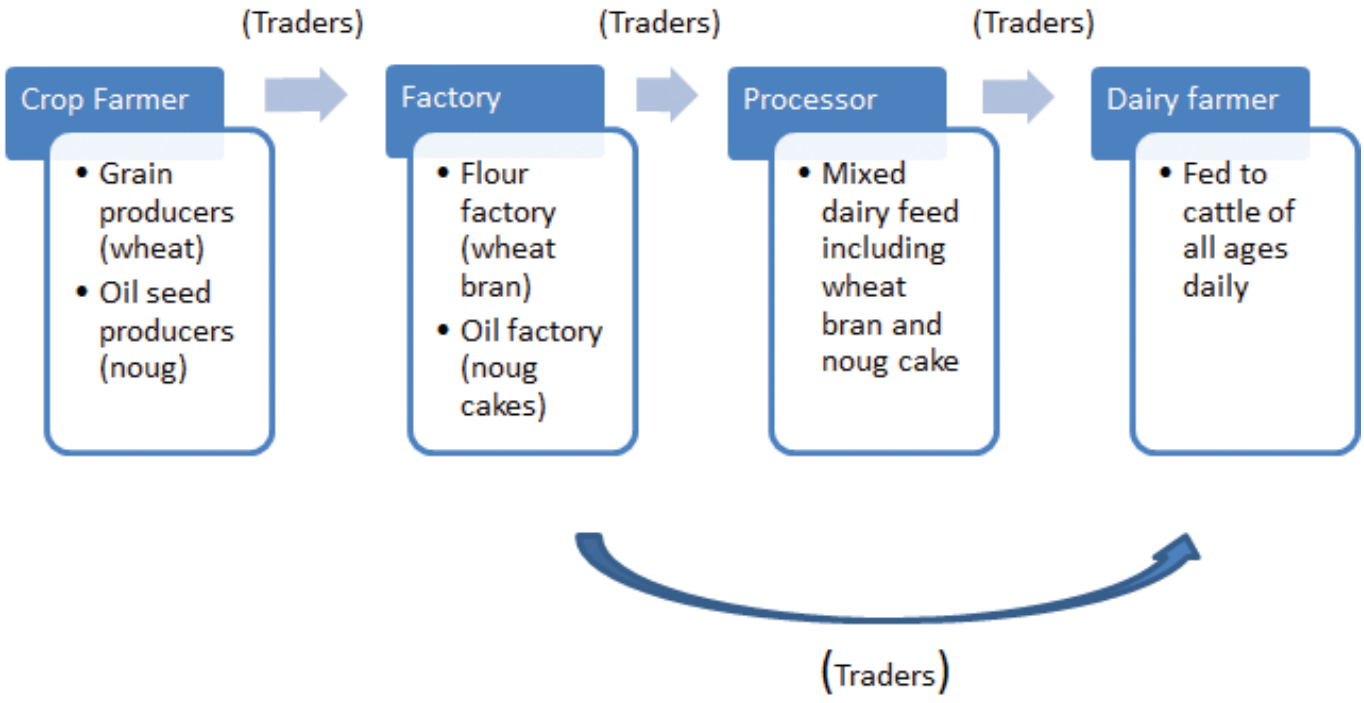
The study adopted a value chain approach by examining the production, processing and marketing of dairy feeds and milk that are sold to consumers in Addis Ababa.

- Structured questionnaires were administered to the main value chain actors, namely feed manufacturers, feed processors, feed traders, dairy farmers and milk collectors.
- Feed samples were collected from dairy feed manufacturers, processors and traders.
- Milk samples were collected from dairy farmers and milk collectors.

Recommendations for intervention and further research

- The high level of aflatoxin contamination in the peri-urban dairy value chain of Addis Ababa requires urgent response to reduce human and animal exposure to these toxins.
- There is a need to increase awareness of aflatoxins and support risk mitigation practices along the dairy value chain.
- Policymakers need to support the dissemination of information about simple risk-reduction measures including proper drying, sorting, sanitation, proper storage and insect management, among others.
- The humidity of grains and feeds, particularly noug cake stored for long periods should be regularly monitored with suitable equipment.
- Messages on Good Manufacturing Practices focused particularly on food safety and milk hygiene should be included in the training packages that development organizations deliver to the dairy sector in Ethiopia.
- Risk assessment of aflatoxins in noug seed and its by-products (particularly noug cake) in other food chains should be carried out.
- Further research should focus on risk mitigation targeted at noug cakes as the primary source of aflatoxin contamination in the greater Addis Ababa dairy value chain.

The peri-urban dairy sector of Addis Ababa is commercial and uses specialized inputs such as improved breeds, but milking is mostly done by hand.



Noug cake is a by-product from oil factories. The figure shows the production and fate of wheat bran and noug cake, the two most commonly used ingredients in concentrate feeds in the greater Addis Ababa milk shed.

Photo credit: Hiwot Assefa

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Livestock and irrigation value chains for Ethiopian smallholders project aims to improve the competitiveness, sustainability and equity of value chains for selected high-value livestock and irrigated crop commodities in target areas of four regions of Ethiopia. It identifies, targets and promotes improved technologies and innovations to develop high value livestock and irrigated crop value chains; it improves the capacities of value chain actors; it improves the use of knowledge at different levels; it generates knowledge through action-oriented research; and it promotes and disseminates good practices. Project carried out with the financial support of the Government of Canada provided through Foreign Affairs, Trade and Development Canada (DFATD). lives-ethiopia.org

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June 2015